MATHS

BOOKS - MODERN PUBLICATION

SAMPLE PAPER 2017

Exercise

1. If I_n is an identity matrix of order n, then k being a natural number, write the matrix I_n^k.

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2. Write the number of ways in which 5 boys and 5 girls can sit around a round table.

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3. One card is drawn from a pack of 52 cards.Write the probability that the card drawn is either a king or a spade.

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4. Write the equation of the plane meeting the coordinate axes in A,B and C in order, given that (a,b,c) is the centroid of $\triangle ABC$.

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5. Write the value of $\int_0^1 \{x\}dx$ where {x} stands for fractional part of x.

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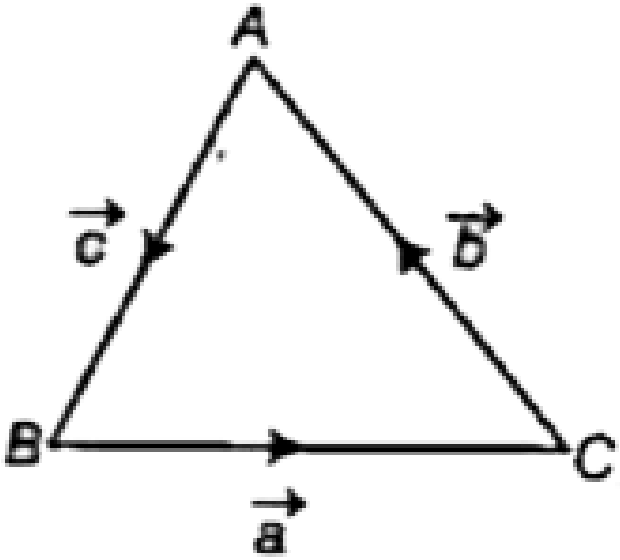
6. It the vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ form the sides $\overrightarrow{BC}, \overrightarrow{CA}$ and $\overrightarrow{AB}$ respectively of a triangle ABC, then write the value of $\vec{a} \times \vec{c} + \vec{b} \times \vec{c}$.



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7. Write the interval in which the function $\sin^2 x - x$ is increasing.

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8. Verify Cauchy's mean value for the functions $f(x) = \sin x, g(x) = \cos x$ in $\left[0, \frac{\pi}{2}\right]$

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9. Find the equation of the normal to the curve $y = (\log x)^2$ at $x = \frac{1}{e}$.

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10. If $U = \ln\left(x^3 + y^3 + z^3 - 3xyz\right)$, show that $\frac{\delta u}{\delta x} + \frac{\delta u}{\delta y} + \frac{\delta u}{\delta z} = \frac{3}{x + y + z}$

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11. Evaluate: $\lim_{x \to 1} \frac{1}{x^{1-x}}$

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12. If $y = x^4 e^{2x}$, then find, $\frac{dy}{dx}$.

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13. If $y = \left(x + \frac{1}{x + \frac{1}{x + \ldots \infty}} \right)$ find $\frac{dy}{dx}$, the rhs being a valid expression.

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14. What is the derivative of $\sec^{-1}\left(\frac{1}{2x^2 - 1} \right)$, with respect to $\left(\sqrt{1 - x^2} \right)$?

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15. Solve the following differential equation

$$\left(x + 2y^3\right)\frac{dy}{dx} = y.$$

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16. Solve the following second order equations

$$\cos ecx\frac{d^2y}{dx^2} = x$$

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17. Evaluate : $\int x^2 \tan^{-1} x dx.$

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18. $\int_0^a x^3 \left(a^2 - x^2\right)^{\frac{5}{2}} dx$

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19. Evaluate: $\int_0^a \frac{dx}{e^{4x} - 5}$

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20. Evaluate $\int_{-1}^{2} \{|x| + [x]\} dx$

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21. Find the feasible region of the system.

$2y - x \geq 0, 6y - 3x \leq 21, x \geq 0, y \geq 0$

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22. Solve the following LPP graphically

Maximize, $Z = 20x + 30y$

Subject to $3x + 5y \leq 15$

$x, y \geq 0.$

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23. Find the co-ordinates of the point where the perpendicular from the origin meets the line joining the points $(-9, 4, 5)$ and $(11, 0, -1)$.

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24. Find the value of a for which the plane $x + y + z - a = 0$ will touch the sphere $x^2 + y^2 + z^2 - 2x - 2y - 2z - 6 = 0$

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25. If $\vec{p} = \frac{1}{\lambda}\left(\vec{b} \times \vec{c}\right), \vec{q} = \frac{1}{\lambda}\left(\vec{c} \times \vec{a}\right)$ and $\vec{r} = \frac{1}{\lambda}\left(\vec{a} \times \vec{b}\right)$ where $\lambda = \left[\vec{a}\ \vec{b}\ \vec{c}\right] \neq 0$ then show that $\left(\vec{a} + \vec{b} + \vec{c}\right) \cdot \left(\vec{p} + \vec{q} + \vec{r}\right) = 3.$

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26. Find the equation of the plane through the point (2,1,0) and passing through the intersection of the planes $3x - 2y + z - 1 = 0$ and $x - 2y + 3z = 1.$

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27. Prove that the vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$, $3\hat{i} - 4\hat{j} - 4\hat{k}$ are the sides of a right angled triangle.

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28. If $\vec{a} = 3\hat{i} + \hat{j} + 2\hat{k}, \vec{b} = 2\hat{j} - 3\hat{j} + 4\hat{k}$ then verify that $\vec{a} \times \vec{b}$ is perpendicular to both $\vec{a}$ and $\vec{b}$.

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29. Five boys and four girls randomly stand in a line. Find the probability that no two girls come together.

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30. If a random variable X has a binomial distribution B $\left(8, \frac{1}{2}\right)$ then find X for which the outcome is the most likely.

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31. A cricket team consisting of 11 players is to be chosen from 8 batsmen and 5 bowlers. In how many ways can the team be chosen so as to include at least 3 bowlers.

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32. Find the inverse of the following matrix:

$$\begin{bmatrix} 0 & 0 & 2 \\ 0 & 2 & 0 \\ 2 & 0 & 0 \end{bmatrix}$$

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33. If $P(n-1,3):P(n+1,3)=5:12$, find n.

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34. Solve by Cramer's rule $2x-y=2, 3x+y=13$

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35. If the matrix A is such that $\begin{bmatrix}1 & -1\\ 2 & 3\end{bmatrix}A=\begin{bmatrix}-4 & 1\\ 7 & 7\end{bmatrix}$, find A.

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36. A cylindrical open water tank with a circular base is to be made out of 30 sq metres of metal sheet. Find the dimensions so that it can hold maximum water. (Neglect thickness of sheet).

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37. If $y = x \log\left(\frac{x}{a+bx}\right)$ then prove that $x^3 \frac{d^2y}{dx^2} = \left(x\frac{dy}{dx} - y\right)^2$.

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38. Solve $\frac{dx}{dy} = \frac{3x - 7y + 7}{3y - 7x - 3}$

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39. Evaluate $\int \frac{dx}{\cos x(1 + 2\sin x)}$

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40. Show that the line joining the points $(0, 2, -4)$ and $(-1, 1-2)$ and the lines joining the points $(-2, 3, 3)$ and $(-3, -2, 1)$ are co-plannr. Find their point of intersection.

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41. Prove the following by vector method. An angle inscribed in a semi-circle is a right angle.

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42. Show that $\hat{i} \times \left(\vec{a} \times \hat{i}\right) + \hat{j} \times \left(\vec{a} \times \hat{j}\right) + \hat{k} \times \left(\vec{a} \times \hat{k}\right) = 2\vec{a}$

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43. The probability that a student will pass the final examination in both English and Hindi is 0.5 and the probability of passing neither is 0.1. If the probability of passing English examination is 0.75, what is the probability of passing the Hindi Examination?

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44. If $P(A) = 0.4$, $P(B/A) = 0.3$ and $P\left(\frac{B^c}{A^c}\right) = 0.2$. Find $P(B)$.

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45. Prove the following:

$$\begin{bmatrix} (b+c)^2 & a^2 & bc \\ (c+a)^2 & b^2 & ca \\ (a+b)^2 & c^2 & ab \end{bmatrix}$$

$$=(a^2+b^2+c^2)(a+b+c)(b-c)(c-a)(a-b)$$

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46. Show that $C_1^2 + 2C_2^2 + 3C_3^2 + \ldots + {}^nC_n^2 = \frac{(2n-1!)}{\{(n-1)!\}^2}$

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